Breastfeeding initiation and duration in Chile

Breastfeeding initiation and duration in Chile: Understanding the social and health determinants

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What is already known in this subject?
The numerous medical benefits of breastfeeding support its promotion, so that the international growth of breastfeeding rates is of high importance, particularly in meeting the global breastfeeding targets for 2025. To do so, a better understanding of both initiation and duration of breastfeeding, taking into account cultural differences in determinants specific to differing regions, is first needed. In Chile, fluctuations in breastfeeding rates over time have been observed, from 19% of breastfeeding initiation during the 1970's to 63% reported by UNICEF in 2014. Despite these positive gains in breastfeeding rates, very few studies in Chile have been conducted in order to better understand the specific determinants of breastfeeding initiation and duration; an important endeavour for ensuring future global target rates are achieved.

What this study adds?
Rates of breastfeeding initiation in Chile are high (i.e., 95.2%), exceeding Chilean target goals, although vary by region. Maternal IQ, low risk prenatal behaviours, conditions at birth, and the presence of a partner were relevant predictors of both initiation and duration of breastfeeding, while personality and contextual/socioeconomic factors were relevant only for breastfeeding duration. These findings suggest important targets for policy development and breastfeeding initiatives in Chile, particularly concerning the reduction of surgical deliveries, prevalent in 45.0% of births in this sample.

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Contributors:
CF aided in conceiving the study and its design, analysed and interpreted the data, drafted the initial manuscript and approved the final manuscript as submitted. LCG aided in conceiving the study and its design, the analysis and interpretation of the data and reviewing and revising the manuscript in its initial and final versions. All

authors participated in approving the final version to be published and agreed to be accountable for all aspects of the work by ensuring that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved.

Abstract

Background: Given the support for the numerous benefits of breastfeeding, a better understanding of social and health determinants is necessary, particularly in under researched populations. We examined determinants of breastfeeding initiation and duration using a national cohort of Chilean mothers.

Methods: Participants included 13,738 families enrolled in the Encuesta Longitudinal de la Primera Infancia cohort. Data was collected in 2010 and 2012. Families from all regions of the country were considered. Breastfeeding information was collected via maternal report and standardized assessments were used to collect information on maternal IQ and personality. Logistic and linear regressions were used to identify predictors of breastfeeding initiation and duration.

Results: Breastfeeding was initiated by 95.2% of mothers. Variation in duration of breastfeeding was large, ranging from 1 to 48 months (M=11.74; SD=8.74). Maternal IQ, low risk prenatal behaviours, conditions at birth, and the presence of a partner were relevant predictors of both initiation and duration of breastfeeding, while personality and contextual/socioeconomic factors were relevant only for breastfeeding duration. Differences between regions were observed. Rates of caesarean deliveries are alarmingly high and triple that of the global WHO recommendations, at 45% of deliveries in Chile, which are implicated in both initiation and duration.

Conclusions: Breastfeeding rates exceed Chilean target goals although vary by region. Global targets now need to be focused upon. Social and health determinants are implicated in both initiation and duration of breastfeeding. These findings suggest important targets for policy development and breastfeeding initiatives in Chile, particularly concerning the reduction of surgical deliveries.

Keywords: Breastfeeding initiation; Breastfeeding duration; Chile; Cohort; Epidemiology.

Introduction

The numerous medical benefits of breastfeeding, including reduced risk of breast and ovarian cancer, birth spacing, and type 2 diabetes for mothers, along with obesity, type 1 and 2 diabetes, nonspecific gastroenteritis, severe lower respiratory tract infections, atopic dermatitis, asthma, and high systolic blood pressure for children, have been well documented [1-4]. Additionally, some studies would support the benefits of breastfeeding, exclusive and partial, on children's cognitive, behavioural, and motor development [5-11]. Given the many documented benefits, promotion of breastfeeding, resulting in increases to international growth of breastfeeding rates is of high importance, particularly in meeting the global breastfeeding targets for 2025[12]. To do so, a better understanding of both initiation and duration, taking into account cultural differences in determinants specific to differing regions, is first needed.

There is currently a scarcity of epidemiological studies examining the determinants of breastfeeding initiation and duration in Chile, despite observed fluctuations in breastfeeding rates over time. For example, in the 1970s, most children were not receiving any breastfeeding, with reported initiation rates as low as 19%[13]. Several campaigns, such as the "Chile Crece Contigo" programme, the signing of the Innocenti (WABA) declaration, legislation adjustments to postpartum leave (i.e., an extension from 84 days to 6 months in 2009), and breastfeeding in childcare centres and hospitals being accredited with baby friendly hospital initiative (BFHI) status, have since been implemented in an attempt to boost initiation rates[14], and appear to have gained some success. The target goal for 2000, proposed by the Chilean government in 1990, was to reach 80% of children receiving exclusive breastfeeding up to four months of age and 35% receiving partial breastfeeding up to one year of age[15]. Whilst this goal was not achieved, important increases were observed. For example, five national breastfeeding surveys conducted between 1993 and 2005, which included approximately 10,000 children 18 months or less, in the public health system, revealed a 30% increase in exclusive breastfeeding rates at six months of age (i.e., 46% of children were reported as being exclusively breastfed in the last survey in 2005, as compared to only 16% in 1993)[15]. UNICEF's State of the World 2014 report documented Chile as having seen even further increases in rates of exclusive breastfeeding from those reported in 2005, reaching a

rate of 63% of children who were exclusively breastfed up to six months of age[16]. No data was available regarding initiation or extended breastfeeding rates for Chile in this report.

Despite these positive gains in exclusive breastfeeding rates in particular, very few studies in Chile have been conducted in order to better understand the specific determinants of breastfeeding initiation and duration[17]; an important endeavour for ensuring future global target rates are achieved. Of the limited existing studies, variation in breastfeeding behaviours across regions is apparent. For example, Patagonian children have been found to receive an average of 25.2 months of partial breastfeeding[18], while more than half of rural children from the south-central of Chile are being weaned before six months of age[19]. Studies conducted in Chile between 2006 and 2013 revealed that factors such as younger maternal age, higher education and socioeconomic status, delivery by caesarean, maternal disease, lower milk production, lack of social support networks, information about breastfeeding, and awareness of labour rights, were all implicated in the cessation of exclusive breastfeeding prior to six months [17, 19], with the principle determinant negatively affecting longer breastfeeding duration argued to be Chilean maternal employment conditions[15]. In contrast, a study conducted in 2010 revealed higher rates of exclusive breastfeeding in Chilean mothers with lower educational levels and who belong to the public health system[20]. These latter trends are in stark contrast to studies examining determinants of breastfeeding initiation and duration in developed countries [(e.g., 21-22)]. While these few existing studies help in better understanding some determinants of breastfeeding in Chile, the generalisability of these findings are limited by the small sample sizes used, which have typically been restricted to only one city or location. We build upon the work of previous studies in using a large nationally representative cohort of families from all regions of the country, in order to examine the determinants of both breastfeeding initiation and duration.

Method

Participants

Participants included families enrolled in the "Encuesta Longitudinal de la Primera Infancia, ELPI", (Longitudinal survey of the early infancy)[23] in Chile during 2010 and 2012. This survey is designed to assess

children and their household context and is representative of children born between January 2006 and August 2009 (first wave) and September 2009 and December 2011 (second wave) in both urban and rural areas. Data collection methods used in these two waves were the same across time. In the first wave 15,175 families with children between the ages of seven and 58 months participated, and in the second wave 3,135 additional families were included. Inclusion criteria for this study were children living with their biological mother, with complete data on breastfeeding duration, and who had ceased breastfeeding at the time of interview. This resulted in a sample of 13,738 families (75.0% of the initial sample). A comparison between participants included in the current study and the entire cohort revealed some statistically significant differences between groups (i.e., country region of dwelling, maternal working status, smoking during pregnancy, low birth weight, incubation, preterm birth, and maternal vocabulary). Please see the Online Supplement 1. Parents/guardians were provided with oral and written information about the study and informed consent was given by completion of the first questionnaire. Ethical review and approval for ELPI was granted by Universidad de Chile, Centro de Microdatos (Microdata centre) and have conformed to the principles set out in the Declaration of Helsinki. Demographic characteristics of the included families can be found in Table 1.

Table 1. Family, Maternal, Infant, and Medical Characteristics of the Entire Cohort

	n	%		*n*	%
Regions of the country			Maternal age		
North (I, II, III, IV, XV)	1898	13.8	≤ 17 years	193	1.4
Central (V, VI, XIII)	7425	54.0	18-24 years	4086	29.7
South (VII, VIII, IX, X, XI, XII, XIV)	4415	32.2	25-29 years	3156	23.0
Area of residence			30-34 years	2967	21.6
Urban	12364	90.0	≥ 35 years	3336	24.3
Rural	1374	10.0	Maternal prenatal depression (yes)	1556	11.3
Resident spouse/partner (yes)	9394	68.4	Smoking during pregnancy (yes)	1294	9.4
Health provisional system			Alcohol use during pregnancy (yes)	1007	7.3
Public system	12124	88.3	Drug use during pregnancy (yes)	120	0.9
Private system	1609	11.7	Delivery mode (caesarean)	6170	45.0
Maternal working status (yes)	7075	51.5	Low birth weight (≤2499g, yes)	346	2.7
Occupation			Stay in incubator (yes)	658	4.8
Professional/managerial	1249	9.1	Preterm birth (≤37 weeks, yes)	124	0.9
Non-manual/skilled manual	5333	38.8	Infant sex (boy)	6966	50.7
Semiskilled/unskilled	458	3.3	Siblings living in dwelling (yes)	5025	36.6
Unemployed	6698	48.8	Maternal IQ		
Maternal education			Digit (below average)	8773	66.0
No education or primary incomplete	40	0.3	Vocabulary (below average)	4743	35.7
Primary complete	2208	16.1	Maternal personality (BFI)		
Secondary complete	5502	40.0	Extraversion (low)	2765	21.3
Vocational training (some or complete)	4241	30.9	Agreeableness (low)	1084	8.3
University training (some or complete)	1517	11.0	Conscientiousness (low)	673	5.2
Postgraduates studies	123	0.9	Neuroticism (low)	5970	45.9
Unknown	107	0.8	Openness (low)	1228	9.4

Note: A proxy of maternal IQ was assessed using two subscales of the Wechsler Intelligence Adult Scale, WAIS[23], the digit and vocabulary scales. A below average score is defined as a score of 8 or below on the digit and vocabulary scales. Maternal personality was assessed using the Big Five Inventory, BFI[26]. N = 13738.

Measures

Breastfeeding. Maternal reports were used to collect information on breastfeeding initiation and duration at the first assessment for both waves. Mothers were asked the following three questions: "was the newborn breastfed by his/her biological mother?" (yes/no), "why was he/she not breastfed by his/her biological mother?" (open-ended), and "until what month was the child breastfed by his/her biological mother?". Additionally, while some information on necessary supplementation was collected (i.e., "was it necessary for a supplement to be introduced prior to 6 months in addition to maternal breast milk?" (yes/no)), there was no specific information asked regarding exclusive or partial breastfeeding. Thus, we were unable to examine determinants of exclusive or partial and full breastfeeding in the current study. As a result of the sampling design (i.e., recruiting children between the ages of seven and 58 months), breastfeeding information was collected both retrospectively and prospectively.

Breastfeeding Determinants. Maternal reports were also used to collect information on social and health determinants. These included the region of the country in which the family lived (north, central, south), area of residence (urban, rural), the presence of a spouse/partner in the household (yes/no), the type of health provisional system used (private, public), maternal working status (yes/no), occupation (professional/managerial, non-manual/skilled, semiskilled/unskilled, unemployed), highest level of maternal education achieved (no formal education, primary, secondary, vocational, university, postgraduate studies), maternal age (≤17, 18-24, 25-29, 30-34, ≥35), maternal depression during pregnancy as diagnosed by a healthcare professional (yes/no), smoking during pregnancy (yes/no), alcohol use during pregnancy (yes/no), drug use during pregnancy (yes/no), type of delivery (vaginal, caesarean), low childbirth weight (≤2,500grams, yes/no), preterm birth derived from gestational age (delivery≤ 37 weeks, yes/no), whether the child required incubation following delivery and during the hospital stay (yes/no), sex of the child (boy/girl), and the presence of siblings living in the household (yes/no). Additionally, a proxy of maternal IQ was assessed using the

Wechsler Intelligence Adult Scale, WAIS[24]. This standardised assessment measures adult intellectual performance, using 12 subscales; only two of which were used in the current study. These included the vocabulary subscale, measuring verbal knowledge and concept formation, and the digit span subscale, measuring short-term memory, attention and concentration. Both the vocabulary and digit span subscale were dichotomised into below and above average scores, using the cutoff provided in the manual[25]. The WAIS has been adapted in Chile[25,26], with good reported reliability and validity. Finally, maternal personality was assessed using the Big Five Inventory, BFI[27]. This 44-item inventory assesses individuals on five dimensions including extraversion versus introversion, agreeableness versus antagonism, conscientiousness versus lack of direction, neuroticism versus emotional stability, and openness versus closedness to experience, with scores dichotomised using the threshold suggested in the manual[28].

Statistical Analysis

Frequency of breastfeeding initiation and duration along with reasons for not breastfeeding were first examined. Next, comparative analyses (i.e., Fisher's exact tests and chi-squared tests) of all determinants were conducted between mothers who initiated breastfeeding and those who never breastfed. Chi-squared tests were also used to examine the association between three categories of breastfeeding (i.e., up to six full months, between seven and 12 full months, and 13 months or more) and social and health determinants. Finally, regression analyses were conducted to examine predictors of breastfeeding, first for initiation using logistic regression, and then for duration, using linear regression. Based upon the principle of parsimony, determinants of breastfeeding were only included in these models if they were statistically significant at the bivariate level using an alpha set at .05.

Results

Breastfeeding Frequency and Barriers to Breastfeeding

Almost all mothers in this cohort initiated breastfeeding (i.e., 95.2%). Of the mothers who initiated breastfeeding, 33.5% breastfed up to six full months, 30.7% breastfed between seven and 12 full months, and 31.0% breastfed for extended periods (≥13 months). See Figure 1. Duration of breastfeeding was quite large

and varied between one and 48 months (*M*=11.74, *SD*=8.74). Only 4.8% of mothers did not initiate breastfeeding with their child, with the two most common reasons reported as due to either an insufficient milk supply or because the child rejected breastfeeding (see Table 2).

(Figure 1 here): **Figure 1.** Proportion of breastfeeding rates

Note: Within the context of Chilean target goals for breastfeeding (i.e., 80% of exclusive breastfeeding up to four months of age and 35% of partial breastfeeding up to one year of age[15]), the current sample revealed 79.7% of children were receiving **any** breastfeeding up to full four months of age, and 42.6% received up to full 12 months of age. The ELPI cohort does not provide enough information to assess exclusivity.

Table 2. Reasons for Not Initiating Breastfeeding

	Frequency	Percent
Child related		
Rejected breastfeeding	58	8.7
Incubation	41	6.2
Sickness	22	3.3
Hospitalization	20	3.0
Cleft lip, cleft palate or cleft chin	11	1.7
Adopted	5	0.8
Milk intolerance	2	0.3
Maternal related		
Insufficient milk supply	337	50.8
Sick with use of antibiotics or other medication	46	6.9
Sore nipples	33	5.0
Mastitis	17	2.6
Postpartum depression	14	2.1
Did not want to breastfeed	14	2.1
Use of drugs or alcohol	4	0.6
Breast reduction	1	0.2
Hospitalization	1	0.2
Total	626	

N = 664. A total of 38 cases had missing responses.

Determinants of Breastfeeding Initiation

A lower frequency of breastfeeding initiation was observed in mothers who lived in the north of the country. In comparison, mothers from the south and central areas, had higher levels of breastfeeding initiation. Indeed, for mothers who did not initiate breastfeeding, observed differences revealed an increased tendency to live in urban areas, to be unemployed, to be younger, to have no spouse/partner living in the home, to have been diagnosed during pregnancy with maternal depression by a healthcare professional, and to have engaged in smoking and/or drug use during pregnancy. Additionally, mothers who did not initiate breastfeeding scored lower on IQ (both the digit and vocabulary scales) and had higher scores on neuroticism. Higher frequencies of preterm births, delivery by caesarean, low-birth weight of the infant, and having their infant stay in an

incubator following delivery were also more commonly observed in mothers who did not initiate breastfeeding. Please see Table 3.

Table 3. Breastfeeding Initiation: Social and Health Determinants

	Never breastfed (*n*=664) *n*(%)	Breastfed (*n*=13074) *n*(%)	*Chi square (p)*
Region of the country			11.94 (.003[1])
North	117 (17.6)	1781 (13.6)	
Central	364 (54.8)	7061 (54.0)	
South	183 (27.6)	4232 (32.4)	
Area of residence			3.65 (.033[2])
Urban	612 (92.2)	11752 (89.9)	
Rural	52 (7.8)	1322 (10.1)	
Resident spouse/partner (yes)	412 (62.0)	8982 (68.7)	12.94 (≤.000[2])
Health provisional system			0.22 (.342[2])
Public system	590 (88.9)	11534 (88.3)	
Private system	74 (11.1)	1535 (11.7)	
Mother working status			5.33 (.012[2])
Employed	313 (47.1)	6762 (51.7)	
Not employed	351 (52.9)	6310 (48.3)	
Occupation			6.32 (.097[1])
Professional/managerial	57 (8.6)	1192 (9.1)	
Non-manual/skilled manual	230 (34.6)	5103 (39.0)	
Semiskilled/unskilled	25 (3.8)	433 (3.3)	
Unemployed	352 (53.0)	6346 (48.5)	
Maternal education			7.93 (.160[1])
No education or primary incomplete	2 (0.3)	38 (0.3)	
Primary complete	130 (19.6)	2078 (15.9)	
Secondary complete	264 (39.8)	5238 (40.1)	
Vocational training (some or complete)	190 (28.6)	4051 (31.0)	
University training (some or complete)	64 (9.6)	1453 (11.1)	
Postgraduates studies	5 (0.8)	118 (0.9)	
Unknown	9 (1.4)	98 (0.7)	
Maternal age			10.51 (.033[1])
≤ 17 years	13 (2.0)	180 (1.4)	
18-24 years	225 (33.9)	3861 (29.5)	
25-29 years	130 (19.6)	3026 (23.1)	
30-34 years	130 (19.6)	2837 (21.7)	
≥ 35 years	166 (25.0)	3170 (24.2)	
Maternal prenatal depression (yes)	106 (16.0)	1450 (11.1)	14.94 (≤.000[2])
Smoking during pregnancy (yes)	94 (14.2)	1200 (9.2)	18.57 (≤.000[2])
Alcohol use during pregnancy (yes)	57 (8.6)	950 (7.3)	1.59 (.118[2])
Drug use during pregnancy (yes)	13 (2.0)	107 (0.8)	9.46 (.005[2])
Delivery mode (caesarean)	365 (55.0)	5805 (44.4)	28.28 (≤.000[2])
Low birth weight (≤2499g, yes)	39 (6.6)	307 (2.5)	36.48 (≤.000[2])
Stay in incubator (yes)	96 (14.5)	562 (4.3)	142.65 (≤.000[2])
Preterm birth (≤37 weeks, yes)	27 (4.1)	97 (0.7)	77.98 (≤.000[2])
Infant sex (boy)	328 (49.4)	6638 (50.8)	0.48 (.257[2])
Siblings living in dwelling (yes)	244 (36.7)	4781 (36.6)	0.01 (.479[2])
Maternal IQ			
Digit (below average)	456 (70.9)	8317 (65.8)	7.16 (.004[2])
Vocabulary (below average)	362 (56.3)	5948 (47.1)	20.97 (≤.000[2])
Maternal personality			
Extraversion (low)	135 (21.5)	2630 (21.2)	0.02 (.467[2])
Agreeableness (low)	55 (8.7)	1029 (8.3)	0.15 (.379[2])
Conscientiousness (low)	37 (5.9)	636 (5.1)	0.68 (.232[2])
Neuroticism (low)	261 (41.5)	5709 (46.1)	5.14 (.013[2])
Openness (low)	69 (11.0)	1159 (9.4)	1.81 (.101[2])

[1] Pearson chi square test, [2] Fisher's exact test (for all 2 x 2 contingency tables).

Prior to conducting the multivariate analysis, a check for multicollinearity was first conducted (see Online Supplement 2). As maternal working status and occupation were highly correlated (r=.95, $p \leq$.000), we included only occupation, within the multivariate analyses. Next, a multivariate analysis using logistic regression was conducted to generate a model of the determinants of breastfeeding initiation. The final model included eleven statistically significant determinants of initiation ($\chi^2_{(34)}$=163.424, $p \leq$.000). Consistent with the results from the bivariate analyses, determinants implicated in breastfeeding initiation included mothers from the south and central areas of the country, who live in rural areas, who had a partner/spouse in the home as well as other children, and who scored higher on the vocabulary subscale. In addition, these mothers were less likely to have engaged in high risk prenatal behaviours such as smoking and drug use, to have delivered preterm or by caesarean, or to have had low birth weight infants or infants who stayed in an incubator. Please see Table 4.

Table 4. Determinants of Breastfeeding Initiation: Logistic Regression Analysis

Predictors			95% C.I.for EXP(B)	
	B(SE)	OR	Lower	Lower
Constant	-2.867(.838)	.057**		
Region of the country				
North				
Central	-.296(.122)	.744*	.586	.945
South	-.539(.147)	.583**	.438	.778
Area of residence (urban)	-.335(.169)	.716*	.514	.997
Resident spouse/partner	.224(.100)	1.251*	1.029	1.521
Health provisional system (public)	.091(.149)	1.095	.818	1.466
Occupation				
Professional/managerial				
Non-manual/skilled manual	-.120(.166)	.887	.640	1.228
Semiskilled/unskilled	.066(.272)	1.068	.627	1.820
Unemployed	.066(.161)	1.068	.778	1.465
Maternal education				
No education or primary incomplete				
Primary complete	-.153(.743)	.858	.200	3.678
Secondary complete	-.334(.740)	.716	.168	3.052
Vocational training (some or complete)	-.277(.742)	.758	.177	3.244
University training (some or complete)	-.386(.754)	.680	.155	2.979
Postgraduates studies	-.012(.876)	.988	.178	5.502
Maternal age				
≤ 17 years				
18-24 years	-.062(.329)	.940	.493	1.791
25-29 years	-.179(.340)	.836	.429	1.629
30-34 years	-.181(.346)	.835	.424	1.643
≥ 35 years	.022(.344)	1.022	.521	2.005
Maternal prenatal depression	.243(.128)	1.275	.992	1.638
Smoking during pregnancy	.337(.137)	1.401*	1.071	1.832
Alcohol use during pregnancy	-.018(.168)	.982	.706	1.366
Drug use during pregnancy	1.103(.329)	3.012**	1.580	5.740
Delivery mode (caesarean)	.448(.092)	1.566**	1.308	1.875
Low birth weight (≤2499g)	.560(.202)	1.750**	1.179	2.598
Stay in incubator	.812(.163)	2.252**	1.636	3.100
Preterm birth (≤37 weeks)	1.171(.309)	3.224**	1.759	5.909
Infant sex (boy)	.122(.089)	1.129	.949	1.344
Siblings living in dwelling	.273(.111)	.761*	.612	.946
Maternal IQ				
Digit	.115(.102)	1.122	.919	1.370
Vocabulary	.254(.098)	1.289**	1.063	1.562
Maternal personality				
Extraversion	-.042(.112)	.959	.770	1.195
Agreeableness	-.099(.164)	.905	.656	1.248
Conscientiousness	-.164(.203)	.849	.570	1.264
Neuroticism	-.149(.094)	.862	.716	1.036
Openness	.064(.152)	1.066	.791	1.437
Model	X^2	df	R^2 Nagelkerke	
Likelihood ratio	163.424**	34	.44	
Hosmer & Lemeshow	7.38	8		

***** p≤.05, ** p≤.01.

Determinants of Breastfeeding Duration

With respect to duration, chi-squared analyses revealed that longer durations of breastfeeding were associated with higher prevalence of mothers who lived in the south and central areas of the country, who are unemployed, who lived in rural areas, who had a spouse/partner living in the home, and who were older in age,

similar to the findings for determinants of breastfeeding initiation. Longer durations of breastfeeding were also associated with mothers who worked in less skilled types of employment, who received public health services and for mothers with lower educational background and IQ (on both verbal and digits scales). Mothers that breastfed for longer durations were also more likely to score lower on extraversion. On the other hand, shorter breastfeeding durations were similarly associated with determinants implicated in not having initiated breastfeeding (i.e., prenatal smoking, preterm and caesarean delivery, stay in incubator and low birth weight). Additionally, prenatal alcohol use was associated with a shorter duration. See Table 5.

Table 5. Breastfeeding Duration: Social and Health Determinants

	≥6m (*n*=4600) *n*(%)	7/12m (*n*=4212) *n*(%)	≤13 (*n*=4262) *n*(%)	*Chi square*[1] *(p)*
Region of the country				43.88 (≤.000)
North	627 (13.6)	544 (12.9)	610 (14.3)	
Central	2577 (56.0)	2353 (55.9)	2131 (50.0)	
South	1396 (30.3)	1315 (31.2)	1521 (35.7)	
Area of residence				20.50 (≤.000)
Urban	4202 (91.3)	3780 (89.7)	3770 (88.5)	
Rural	398 (8.7)	432 (10.3)	492 (11.5)	
Resident spouse/partner (yes)	3028 (65.8)	2965 (70.4)	2989 (70.1)	27.35 (≤.000)
Health provisional system				112.04 (≤.000)
Public system	3957 (86.0)	3634 (86.3)	3943 (92.5)	
Private system	642 (14.0)	575 (13.7)	318 (7.5)	
Mother working status				89.03 (≤.000)
Employed	2580 (56.1)	2214 (52.6)	1968 (46.2)	
Not employed	2019 (43.9)	1997 (47.4)	2294 (53.8)	
Occupation				149.93 (≤.000)
Professional/managerial	396 (8.6)	362 (8.6)	434 (10.2)	
Non-manual/skilled manual	2017 (43.8)	1730 (41.1)	1356 (31.8)	
Semiskilled/unskilled	152 (3.3)	117 (2.8)	164 (3.8)	
Unemployed	2035 (44.2)	2003 (47.6)	2308 (54.2)	
Maternal education				279.93 (≤.000)
No education or primary incomplete	13 (0.3)	7 (0.2)	18 (0.4)	
Primary complete	601 (13.1)	563 (13.4)	914 (21.4)	
Secondary complete	1779 (38.7)	1666 (39.6)	1793 (42.1)	
Vocational training	1515 (32.9)	1339 (31.8)	1197 (28.1)	
University training	610 (13.3)	556 (13.2)	287 (6.7)	
Postgraduates studies	51 (1.1)	50 (1.2)	17 (0.4)	
Unknown	31 (0.7)	31 (0.7)	36 (0.8)	
Maternal age				44.04 (≤.000)
≤ 17	80 (1.7)	64 (1.5)	36 (0.8)	
18-24	1440 (31.3)	1151 (27.3)	1270 (29.8)	
25-29	1064 (23.1)	997 (23.7)	965 (22.6)	
30-34	933 (20.3)	1001 (23.8)	903 (21.2)	
≥ 35	1083 (23.5)	999 (23.7)	1088 (25.5)	
Maternal prenatal depression (yes)	528 (11.5)	463 (11.0)	459 (10.8)	1.19 (.552)
Smoking during pregnancy (yes)	507 (11.0)	311 (7.4)	382 (9.0)	35.11 (≤.000)
Alcohol use during pregnancy (yes)	386 (8.4)	290 (6.9)	274 (6.4)	13.99 (.001)
Drug use during pregnancy	40 (0.9)	37 (0.9)	30 (0.7)	1.03 (.598)
Delivery mode (Caesarean)	2215 (48.2)	1902 (45.2)	1688 (39.7)	66.62 (≤.000)
Low birth weight (≤2499g, yes)	136 (3.2)	93 (2.3)	78 (1.9)	13.35 (.001)
Stay in incubator (yes)	240 (5.2)	159 (3.8)	163 (3.8)	14.50 (.001)
Preterm birth (≤37 weeks, yes)	58 (1.3)	23 (0.5)	16 (0.4)	26.79 (≤.000)
Infant sex (boy)	2357 (51.2)	2106 (50.0)	2175 (51.0)	1.52 (.467)

Siblings living in dwelling (yes)	1710 (37.2)	1526 (36.2)	1545 (36.3)	1.12 (.571)
Maternal IQ				
Digits (below average)	2859 (64.2)	2581 (63.4)	2877 (69.9)	45.98 (≤.000)
Vocabulary (below average)	1977 (44.4)	1801 (44.2)	2170 (52.7)	78.40 (≤.000)
Maternal personality				
Extraversion (low)	864 (19.8)	865 (21.7)	901 (22.4)	9.11 (.011)
Agreeableness (low)	386 (8.8)	296 (7.4)	347 (8.6)	6.29 (.043)
Conscientiousness (low)	259 (5.9)	170 (4.3)	207 (5.1)	11.95 (.003)
Neuroticism (low)	1929 (44.2)	1978 (49.6)	1802 (44.8)	28.70 (≤.000)
Openness (low)	403 (9.2)	371 (9.3)	385 (9.6)	0.30 (.859)

[1] Pearson chi square test

Multivariate analysis using linear regression revealed thirteen determinants of breastfeeding duration ($F_{(13, 11542)}$=30.153, p≤.000). Determinants of longer durations included mothers who were in the public tier of the health provisional system, who were from a lower occupation, who had a partner/spouse in the home, who scored lower on IQ (both vocabulary and digit scales), with lower levels of education, who were older, and who were lower in neuroticism. Additionally, these mothers were less likely to have engaged in high risk prenatal behaviours such as drinking and smoking, to have delivered preterm or by caesarean, or to have had low birth weight infants. Please see Table 6.

Table 6. Determinants of Breastfeeding Duration: Linear Regression Analysis

Predictors	B	S.E.	β	p-value	95% C.I.for B	
					Lower	Upper
Constant	2.284	.123		≤.000	2.043	2.526
Region of the country	-.006	.013	-.005	.661	-.032	.020
Area of residence	.022	.026	.008	.390	-.029	.073
Resident spouse/partner	-.044	.018	-.025	.011	-.079	-.010
Health provisional system	-.070	.013	-.055	≤.000	-.095	-.045
Mother occupation	.032	.007	.044	≤.000	.018	.046
Maternal education	-.074	.010	-.083	≤.000	-.093	-.055
Maternal age	.007	.001	.063	≤.000	.005	.010
Maternal prenatal depression	-.010	.025	-.004	.678	-.059	.038
Smoking during pregnancy	-.084	.027	-.029	.002	-.137	-.030
Alcohol use during pregnancy	-.063	.030	-.020	.036	-.121	-.004
Drug use during pregnancy	.016	.088	.002	.858	-.157	.188
Delivery mode (caesarean)	-.096	.016	-.058	≤.000	-.127	-.065
Low birth weight	-.144	.049	-.027	.004	-.241	-.047
Stay in incubator	-.071	.041	-.016	.081	-.151	.009
Preterm birth	-.345	.099	-.033	≤.000	-.539	-.152
Child sex (boy)	-.002	.015	-.001	.914	-.031	.028
Siblings living in dwelling	-.005	.004	-.011	.278	-.013	.004
Maternal IQ						
Digits (below average)	-.069	.019	-.040	≤.000	-.105	-.032
Vocabulary (below average)	-.001	.001	-.030	.006	-.002	.000
Maternal personality						
Extraversion (low)	-.017	.011	-.015	.140	-.039	.005
Agreeableness (low)	.002	.014	.002	.883	-.026	.030
Conscientiousness (low)	-.003	.015	-.002	.834	-.032	.026
Neuroticism (low)	-.035	.011	-.034	.001	-.056	-.014
Openness (low)	.019	.014	.014	.171	-.008	.045
Model			F	df		
Regression			30.153	13		
R^2 adjusted			.32**			

** p≤.01.

Discussion

Our results document important contributions for understanding determinants of breastfeeding initiation and duration in an under researched population, i.e., Chilean mothers. In this cohort, only 4.8% of mothers did not initiate breastfeeding, which is in contrast with previous studies that reported up to 20% of mothers who did not initiate breastfeeding in Chile[15]. This would support positive gains in initiation rates over the past four decades. This finding is promising given the importance of initiation for exclusive breastfeeding, particularly with respect to early initiation[29]. Related to the duration of breastfeeding, our findings revealed that 72.6% of children received any breastfeeding up to six months of age, which is higher than the 46% reported in Chile in 2005[15] and similar to the 63% reported by UNICEF in 2014[16]. In addition, 42.6% of the children in this cohort were still being breastfed at one year of age, as compared to only 35% in the early 1990's in Chile[15].

The results suggest that determinants implicated in breastfeeding initiation in Chile, include maternal behaviours during pregnancy, health, and social factors. In particular, mothers who smoke or used drugs during their pregnancy were less likely to initiate breastfeeding. When the infant was delivered surgically (i.e., by caesarean), was born preterm, was of lower birth weight, or had to stay in an incubator following delivery and during the hospital stay, there was also a lower frequency of breastfeeding initiation, likely driven by the increased probability of disruption to early skin-to-skin contact immediately following delivery[30]. Additionally, it may be possible that differences in maternal hormonal levels or higher stress levels [e.g., 31, 32], may have also negatively impacted on breastfeeding initiation. Residing in the north and in urban areas, a lack of support (i.e., the absence of spouse/partner at home) and lower scores on the vocabulary IQ subscale, were relevant determinants for not initiating breastfeeding. These findings related to determinants of initiation reveal similar patterns of maternal profiles and confounding structure from those found in both Chilean[17,19] and in North American and European studies [e.g., 21,22,33]. These factors should be considered in the planning of future public policies related to long-term improvement of health in Chile.

Two target goals set by the Chilean government to promote breastfeeding in the population by 2000, included reaching 80% of infants being exclusively breastfed up to four months of age and 35% of infants partially breastfed up to one year of age. Whilst our data lacked information on exclusivity, our results reveal that between 2006 and 2011, Chile had been able to meet the latter target goal, with 42.6% of infants being breastfed for at least twelve full months. This result is highly promising. Similar to initiation, determinants of breastfeeding duration in this cohort related to maternal behaviours during pregnancy, along with health and social factors. Moreover, maternal characteristics and personality were also implicated in breastfeeding duration. Related to maternal behaviours, maternal smoking during pregnancy once again had negative implications on breastfeeding (i.e., these mothers were more likely to breastfed for shorter durations). Drug use during pregnancy was not a determinant for duration, however alcohol use during pregnancy was more frequent in mothers who breastfed for shorter durations. Investment into education programmes and early support such as counselling for mothers who engage in risky prenatal behaviours should thus be of high priority in targeting behavioural change in Chile. This may have positive implications in maintaining national target goals.

Health related factors common to initiation in predicting duration included delivery by caesarean, preterm delivery, and having a low birth weight infant. The high rates of caesareans observed in this sample (i.e., 45.0% of births), are of great concern, not only because it is a detrimental determinant of both breastfeeding initiation and duration, but also because caesarean deliveries have been associated with both increased maternal and newborn mortality rates, along with the potential for additional complications during and after delivery[34]. Thus, the WHO has recommended rates no higher than 10-15% of all deliveries by caesarean in any region[34]. Taken together, the national health programme in Chile must pay urgent attention to this matter given the implications for both breastfeeding and mortality.

Maternal characteristics such as age, along with personality factors, such as neuroticism, and social factors (i.e., resident spouse/partner, occupation, education and tier of the health system), were also of importance in breastfeeding duration. Of interest, mothers who breastfed for extended durations typically

scored lower on both the vocabulary and digits scales measuring IQ, were more likely to be unemployed, to have lower levels of education and to belong to the public health system. This result, specifically in relation to maternal cognitive skills, is in contrast to our findings on initiation of breastfeeding, whereby mothers who initiated breastfeeding tended to have higher scores on cognitive abilities. One possibility for this finding may relate to the fact that higher cognitive abilities may be associated with higher employment rates, which have been found to be negatively associated with longer durations of breastfeeding[15]. These determinants for engagement in longer durations of breastfeeding are not entirely coherent with findings from developed countries, reaffirming that targets of breastfeeding campaigns need to be tailored in culturally appropriate ways to ensure optimal gains.

The inherent strengths of this study include the use of a nationally representative cohort that included families from both the public and private health system, sampled from all regions of the country, with a proxy of maternal IQ (i.e., vocabulary and digits scales of the WAIS), which is in contrast to previous studies conducted in Chile. Despite these strengths, some limitations must be noted. For some mothers, information on breastfeeding was collected retrospectively. Thus, recall bias is possible, particularly regarding the duration of breastfeeding. Additionally, no information related specifically to the cessation of exclusive breastfeeding was collected, which ought to be considered by future studies, particularly as it relates to better understanding how to ensure the global breastfeeding target for 2025 is achieved (i.e., 50% of infants receiving exclusive breastfeeding at six months of age)[35]. Further, only 75% of families from the entire cohort were included in the current study due to inclusion criteria. A comparison between the sample used in this study and the entire cohort revealed some statistically significant differences between groups, where mothers from this sample were more likely to live in the central area of the country, be employed, and scored higher on the measure of vocabulary. In contrast, mothers from the entire cohort were more likely to have engaged in smoking during pregnancy, have had their babies stay in an incubator, be of low birth weight and have a preterm birth. Thus, our results may be specific to the subsample used. Finally, given maternal reports were used to collect information on social and health determinants along with breastfeeding information, shared method variance

needs to be considered. Despite these limitations, our findings add knowledge to the growing literature in the field, in better understanding specific determinants of both breastfeeding initiation and duration within a Chilean context. Moreover, our findings suggest important targets that should be addressed in future policy and programming development to ensure Chile continues to experience high levels of infants who are being breastfed, in line with the WHO global recommendations for optimal breastfeeding. Of concern, the large frequencies of surgical deliveries are exceedingly high and must be addressed moving forward. In the context of the many medical and psychological benefits of breastfeeding, our results offer encouraging findings.

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